



RECEIVED

AUG 13 2003

TECH CENTER 1600/2900

100806\_01US1.ST25.txt  
SEQUENCE LISTING

<110> Actino Drug Pharmaceuticals GmbH  
<120> Method of modifying peptide synthetases such that they can N-methylate their substrate amino acids  
<130> 100806.01US1  
<140> US 10/018,113  
<141> 2001-12-14  
<150> DE 199 28 31.3-41  
<151> 1999-06-16  
<150> PCT/DE00/01950  
<151> 2000-06-15  
<160> 78  
<170> PatentIn version 3.2  
<210> 1  
<211> 3849  
<212> DNA  
<213> Streptomyces chrysomallus  
<400> 1

ggatccacct gctcgacacc gccaccgccc aacccgagca gcccctcagc cgcatcgacg 60  
tcctcacccc ggaggagagg aaccgcacga tcgtcgaggt caaccggacc gaactgccgc 120  
tgcccgacgc ctcgttggcg gagctgttcg aacaacaggt gaccctcaca cccgacgccc 180  
ccgcccgtt cagcgacggc gccacgctca gctactccga gctcaacacg cgcgccaacc 240  
acctcgccca ccagctcacc acccggggca tccgccccgg cgacgcccgtc gccgtcctcc 300  
tccaacgctc ccccgacacc gtcaccaccc tcctcgccct cgccaagacc ggcgcgaccc 360  
acatccccct cgacagccgc taccggccg accgctaccg cctcgtcctc gacgagaccc 420  
gcaccaaact cctcatcacc gaccacacca ccgacctcga caccaccaca acccagttca 480  
accccgccga caccggccac gacggcgaag accccggcaa cccgaaccac accacccacc 540  
ccgacgacgc cgcc tacatc atgtacacca gcggctccac cggccgcccc aaggcggtca 600  
tcgcccacca ccgcaacatc accggccctcg ccctcgaccc ccgttcgac cccaccgccc 660  
accgccgcgt ctcctccac tccccaccc cttcgacgc ctccacctac gagatctggg 720  
tccccctcct caacggcaac accgtcgcc tcgccccac cggcgaccc gacgtccaca 780  
cctaccaccc cgatcatcacc gaccaggaga tcaccgcct ctggctgacc agctgggtct 840  
tcaacctcct caccgagcag agcccgaga cttcacccg ggtccggcag atctggaccg 900  
gcggcgaggc cgtctccggc gccaccgtca cccggcttca gcaggcatgc cccgacacca 960  
ccgtggtcga cggctacggc cccaccgaga ccaccaccc acggccatgc cccgacacca 1020

100806\_01US1.ST25.txt

ccaccccccta caccggctcc gccgtcggtcc	ccatggccg ccccatggcc accatgcaca	1080
cctacgtgct cgacgacagc ctccagcccg tcgccccccgg	cgtcaccggc gagctctacc	1140
tcgctggcag cggcctcgcc cgccgttacc tggaccggcc	cgccctcacc gccgaacgct	1200
tcgtcgccaa cccgtacgcc gcacccggag aacgcatgta	ccgcaccggc gacctggcac	1260
gctgaaaccc cgacgaccac ctgcgtacg ccggccgcgc	cgaccaccag gtcaagggtcc	1320
gcggcttccg catcgaaacc ggcgagatcg agaacgtctt	caccgaccat cccgcccgtcg	1380
cccaggccgc cgtccaccc aaccgggacc agcccgaa	ccccggctc gtcgcgtacg	1440
tcgtcgccga cacctcgccg ccgagcagcg atgtggacca	gcagcaccag atcggcgagt	1500
ggcaggacct ctacgactcc ctctacgcgg ccccccacggc	cgagttcgcc gaggacttct	1560
ccggctggaa cagcagctac gacggccggc cgatccccct	cgaccagatg cgggagtgcc	1620
gcgacgcccac cgtggAACGC atcccgccgc tcaaccccg	ccgggtgctg gagatcgccg	1680
tcggcacggg cctgctgctc gcgaagctgg ccccccagtg	cgaggagtagc tggggcacgg	1740
acctctcgcc caccgtgatc gaggcgctt cccggcacgt	cgacgcccac ccggagctgg	1800
cccgccgggt caccctcgcc gccgggtccg cgacagacca	cgaggggctg cccgtcgcc	1860
acttcgacac cgtcgtgctc aactccgtgg tccagtactt	cccgaaacgcc gactacctcg	1920
cccaggtcat cgagcaggcg ctgcggctgc tgccccccgg	cggccgtcg ttcatcgcc	1980
acatccgcaa cccgcggctg ctgcgcaccc tcaccaccgc	cgtccagacc gcccgcgcgg	2040
aggacccggc cgacaccggc gccgtcgccg ggcggctcga	gcagagcctg gtgctggaga	2100
aggaactcct ggtcgaccccg gagtacttca ccgcgtcac	ccaccgcctc ccggacccctcg	2160
ccggcgtcga cctgcggctc aagtgcggcg ccgcccacaa	cgagttgacc cgctaccgct	2220
acgacaccac gtcacacaag gccggaatca ccgcgtcccc	gctgtccgag gccggccgtcc	2280
tggcttggcc gcaggacgcc gaggactcg cccggcacct	ggccgaggcc cggccggagc	2340
ggctgcgtcg caccggccgc cccaactccc ggatagccgc	cgacctcgcc gcccagcacg	2400
ccctggagtc cggcaccggc ccggccgggc ccccgaccgg	gccctacgcc acggagcagc	2460
cggacccctcgaa ggcactccac cgcctcgaaaa aggaccacgg	gtactggacg gccgtcacct	2520
ggtccgccccca cgcggccgac accgtcgacc tcacccgtt	ccggcgcggc ctgctcgacg	2580
gcgcgtcccccc ggtcggtacg tacccccccgg cggccgcgg	cgaccggcg acgcccgtca	2640
ccgccttcac caccaacccc gtcggcagcc ggggcaccgc	cgcgctgctc accgcgtcg	2700
gcgaacacgc cgccgccccaa ctgcccgtact acatgcggcc	cgccgcaatc gtcccgtcg	2760
accgcctgccc gtcacccgcc aacggcaagc tcgaccggc	cgccctcccg gcactcgacc	2820
cggagcacgc ggacaccggc cgccggccca ggacgcccga	ggagcagggtg gtctgcgagc	2880
tgttcgcggaa ggtcgctcgcc cggccgtcg tcggtgtgaa	ccaggacttc ttgcacccctcg	2940

100806\_01us1.ST25.txt

gcgggcactc gctgctcgcc acccggtga tcgcccggct gcgcgccc	ttcggcgtgg	3000
aactgggcct ggcagcctc ttcgaggcgc cgacgccggg cggatcgcc	gccccggctgg	3060
acctcgacga cccggacggc tcctacgagg tggtgctgcc gctgcgc	caggcagca	3120
ggccggccgtt gttctgcac caccgggtg gcggcatcag ctggcgtac	agcgcgtga	3180
tcaagcacct cggccggag taccgcgtt acggcatcca ggcgc	cagc	3240
cgagccgcg gccggagagc atcgaggaga tggcggtgga ctacg	ccac	3300
gcgtcagcc gcacggcccc taccacctgg ccggctggtc gttcggcggg	ctgtgc	3360
atgcctggc cgccgagttc cagcggcgcg gcgagccgtt ggcgttgc	gcgg	3420
atgtgatccc gaactggcag gggctcaccc acgacgacgt cccggcccc	gacgacc	3480
tgtatgtgtt gtaccacgtc ggcctggtc acgacggcag ccaccg	caac	3540
agctgacctt cgccaggccc cgccgagatcc tgccgc	ggcagtgt	3600
tggaggagga ccggctcacc acgatcaccg agatctggc caacaacacc	catctgacc	3660
tcgactacca gcccggcccg atcgacggcg acctgtgtt gatcgcc	tcggaac	3720
aggacccgccc ggtcaccgc gatgcctggc ggccgtacgt ctgcggc	gtc	3780
acgttgtgcc cggcgagcac ggctccatgc tgaccggcc cggaccctg	gccc	3840
gcccggatcc		3849

<210> 2

<211> 80

<212> PRT

<213> Bacillus brevis

<220>

<223> GRSB\_1 Gramicidin S Synthetase II Pos: 864 to 944

<400> 2

Gln	Val	Lys	Ile	Arg	Gly	His	Arg	Ile	Glu	Leu	Gly	Glu	Ile	Glu	Ala
1				5				10					15		

Gln	Leu	Leu	Asn	Cys	Lys	Gly	Val	Lys	Glu	Ala	Val	Val	Ile	Asp	Lys
					20			25					30		

Ala	Asp	Asp	Lys	Gly	Gly	Lys	Tyr	Leu	Cys	Ala	Tyr	Val	Val	Met	Glu
					35		40				45				

Val	Glu	Val	Asn	Asp	Ser	Glu	Leu	Arg	Glu	Tyr	Leu	Gly	Lys	Ala	Leu
					50		55				60				

Pro	Asp	Tyr	Met	Ile	Pro	Ser	Phe	Phe	Val	Pro	Leu	Asp	His	Val	Arg
				65			70		75				80		

100806\_01US1.ST25.txt

<210> 3  
<211> 80  
<212> PRT  
<213> *Bacillus brevis*

<220>  
<223> GRSB\_2 Gramicidin S Synthetase II Pos: 1900 to 1979

<400> 3

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Pro Gly Glu Ile Glu Thr  
1 5 10 15

Leu Leu Val Lys His Lys Lys Val Lys Glu Ser Val Ile Met Val Val  
20 25 30

Glu Asp Asn Asn Gly Gln Lys Ala Leu Cys Ala Tyr Tyr Val Pro Glu  
35 40 45

Glu Glu Val Thr Val Ser Glu Leu Arg Glu Tyr Ile Ala Lys Glu Leu  
50 55 60

Pro Val Tyr Met Val Pro Ala Tyr Phe Val Gln Ile Glu Gln Met Pro  
65 70 75 80

<210> 4  
<211> 79  
<212> PRT  
<213> *Bacillus brevis*

<220>  
<223> GRSB\_3 Gramicidin S Synthetase II Pos: 2947 to 3025

<400> 4

Gln Val Lys Ile Arg Gly Ile Arg Ile Glu Leu Gly Glu Ile Glu Ala  
1 5 10 15

Gln Leu Arg Lys His Asp Ser Ile Lys Glu Ala Thr Val Ile Ala Arg  
20 25 30

Glu Asp His Met Lys Glu Lys Tyr Leu Cys Ala Tyr Met Val Thr Glu  
35 40 45

Gly Glu Val Asn Val Ala Glu Leu Arg Ala Tyr Leu Ala Asn Asp Arg  
50 55 60

Ala Ala Met Ile Pro Ser Tyr Phe Val Ser Leu Glu Ala Met Pro  
65 70 75

<210> 5

100806\_01US1.ST25.txt

<211> 80  
<212> PRT  
<213> *Bacillus brevis*

<220>  
<223> GRSB\_4 Gramicidin S Synthetase II Pos: 3984 to 4063

<400> 5

Gln Val Lys Val Arg Gly Tyr Arg Ile Glu Leu Gly Glu Ile Glu Ser  
1 5 10 15

Ala Ile Leu Glu Tyr Glu Lys Ile Lys Glu Ala Val Val Met Val Ser  
20 25 30

Glu His Thr Ala Ser Glu Gln Met Leu Cys Ala Tyr Ile Val Gly Glu  
35 40 45

Glu Asp Val Leu Thr Leu Asp Leu Arg Ser Tyr Leu Ala Lys Leu Leu  
50 55 60

Pro Ser Tyr Met Ile Pro Asn Tyr Phe Ile Gln Leu Asp Ser Ile Pro  
65 70 75 80

<210> 6  
<211> 82  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> SRF1\_1 Surfactin Synthetase 1 Pos: 863 to 944

<400> 6

Gln Val Lys Val Arg Gly Tyr Arg Ile Glu Leu Gly Glu Ile Glu Ala  
1 5 10 15

Val Ile Gln Gln Ala Pro Asp Val Ala Lys Ala Val Val Leu Ala Arg  
20 25 30

Pro Asp Glu Gln Gly Asn Leu Glu Val Cys Ala Tyr Val Val Gln Lys  
35 40 45

Pro Gly Ser Glu Phe Ala Pro Ala Gly Leu Arg Glu His Ala Ala Arg  
50 55 60

Gln Leu Pro Asp Tyr Met Val Pro Ala Tyr Phe Thr Glu Val Thr Glu  
65 70 75 80

Ile Pro

100806\_01us1.ST25.txt

<210> 7  
<211> 80  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> SRF1\_2 Surfactin Synthetase 1 Pos: 1904 to 1983

<400> 7

Gln Val Lys Ile Arg Gly Gln Arg Ile Glu Leu Gly Glu Ile Glu His  
1 5 10 15

Gln Leu Gln Thr His Asp Arg Val Gln Glu Ser Val Val Leu Ala Val  
20 25 30

Asp Gln Gly Ala Gly Asp Lys Leu Leu Cys Ala Tyr Tyr Val Gly Glu  
35 40 45

Gly Asp Ile Ser Ser Gln Glu Met Arg Glu His Ala Ala Lys Asp Leu  
50 55 60

Pro Ala Tyr Met Val Leu Arg Cys Leu Ser Lys Trp Thr Glu Leu Pro  
65 70 75 80

<210> 8  
<211> 79  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> SRF1\_3 Surfactin Synthetase 1 Pos: 2934 to 3012

<400> 8

Gln Val Lys Val Arg Gly Tyr Arg Ile Glu Leu Ser Glu Ile Glu Val  
1 5 10 15

Gln Leu Ala Gln Leu Ser Glu Val Gln Asp Ala Ala Val Thr Ala Val  
20 25 30

Lys Asp Lys Gly Gly Asn Thr Ala Ile Ala Ala Tyr Val Thr Pro Glu  
35 40 45

Ser Ala Asp Ile Glu Ala Leu Lys Ser Ala Leu Lys Glu Thr Leu Pro  
50 55 60

Asp Tyr Met Ile Pro Ala Phe Trp Val Thr Leu Asn Glu Leu Pro  
65 70 75

<210> 9  
<211> 80  
<212> PRT

100806\_01US1.ST25.txt

<213> Bacillus subtilis

<220>

<223> SRF2\_1 Surfactin Synthetase 2 Pos: 860 to 939

<400> 9

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Leu Gly Glu Ile Glu Thr  
1 5 10 15

Lys Leu Asn Met Ala Glu His Val Thr Glu Ala Ala Val Ile Ile Arg  
20 25 30

Lys Asn Lys Ala Asp Glu Asn Glu Ile Cys Ala Tyr Phe Thr Ala Asp  
35 40 45

Arg Glu Val Ala Val Ser Glu Leu Arg Lys Thr Leu Ser Gln Ser Leu  
50 55 60

Pro Asp Tyr Met Val Pro Ala His Leu Ile Gln Met Asp Ser Leu Leu  
65 70 75 80

<210> 10

<211> 79

<212> PRT

<213> Bacillus subtilis

<220>

<223> SRF2\_2 Surfactin Synthetase 2 Pos: 1899 to 1977

<400> 10

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Pro Lys Glu Ile Glu Thr  
1 5 10 15

Val Met Leu Ser Leu Ser Gly Ile Gln Glu Ala Val Val Leu Ala Val  
20 25 30

Ser Glu Gly Gly Leu Gln Glu Leu Cys Ala Tyr Tyr Thr Ser Asp Gln  
35 40 45

Asp Ile Glu Lys Ala Glu Leu Arg Tyr Gln Leu Ser Leu Thr Leu Pro  
50 55 60

Ser His Met Ile Pro Ala Phe Phe Val Gln Val Asp Ala Ile Pro  
65 70 75

<210> 11

<211> 79

<212> PRT

<213> Bacillus subtilis

<220>

100806\_01US1.ST25.txt

<223> SRF2\_3 Surfactin Synthetase 2 Pos: 2929 to 3007

<400> 11

Gln Val Lys Val Arg Gly Tyr Arg Ile Glu Leu Ser Glu Ile Glu Val  
1 5 10 15

Gln Leu Ala Gln Leu Ser Glu Val Gln Asp Ala Ala Val Thr Ala Val  
20 25 30

Lys Asp Lys Gly Gly Asn Thr Ala Ile Ala Ala Tyr Val Thr Pro Glu  
35 40 45

Thr Ala Asp Ile Glu Ala Leu Lys Ser Thr Leu Lys Glu Thr Leu Pro  
50 55 60

Asp Tyr Met Ile Pro Ala Phe Trp Val Thr Leu Asn Glu Leu Pro  
65 70 75

<210> 12

<211> 80

<212> PRT

<213> Bacillus subtilis

<220>  
<223> SRF3\_1 Surfactin Synthetase 3 Pos: 863 to 942

<400> 12

Gln Val Lys Ile Arg Gly His Arg Ile Glu Leu Glu Glu Ile Glu Lys  
1 5 10 15

Gln Leu Gln Glu Tyr Pro Gly Val Lys Asp Ala Val Val Val Ala Asp  
20 25 30

Arg His Glu Ser Gly Asp Ala Ser Ile Asn Ala Tyr Leu Val Asn Arg  
35 40 45

Thr Gln Leu Ser Ala Glu Asp Val Lys Ala His Leu Lys Lys Gln Leu  
50 55 60

Pro Ala Tyr Met Val Pro Gln Thr Phe Thr Phe Leu Asp Glu Leu Pro  
65 70 75 80

<210> 13

<211> 80

<212> PRT

<213> Bacillus brevis

<220>  
<223> TYCB\_1 Tyrocidine Synthetase II Pos: 866 to 945

<400> 13

100806\_01US1.ST25.txt

Gln Val Lys Ile Arg Gly His Arg Ile Glu Leu Gly Glu Ile Glu Ser  
1 5 10 15

Arg Leu Leu Asn His Pro Ala Ile Lys Glu Ala Val Val Ile Asp Arg  
20 25 30

Ala Asp Glu Thr Gly Gly Lys Phe Leu Cys Ala Tyr Val Val Leu Gln  
35 40 45

Lys Ala Leu Ser Asp Glu Glu Met Arg Ala Tyr Leu Ala Gln Ala Leu  
50 55 60

Pro Glu Tyr Met Ile Pro Ser Phe Phe Val Thr Leu Glu Arg Ile Pro  
65 70 75 80

<210> 14

<211> 80

<212> PRT

<213> *Bacillus brevis*

<220>

<223> TYCB\_2 Tyrocidine Synthetase II Pos: 1901 to 1980

<400> 14

Gln Ile Lys Val Arg Gly Tyr Arg Ile Glu Val Gly Glu Ile Glu Ala  
1 5 10 15

Val Leu Leu Ala Tyr Asp Gln Thr Asn Glu Ala Ile Val Val Ala Tyr  
20 25 30

Gln Asp Asp Arg Gly Asp Ser Tyr Leu Ala Ala Tyr Val Thr Gly Lys  
35 40 45

Thr Ala Ile Glu Glu Ser Glu Leu Arg Ala His Leu Leu Arg Glu Leu  
50 55 60

Pro Ala Tyr Met Val Pro Thr Tyr Leu Ile Gln Leu Asp Ala Phe Pro  
65 70 75 80

<210> 15

<211> 80

<212> PRT

<213> *Bacillus brevis*

<220>

<223> TYCB\_3 Tyrocidine Synthetase II Pos: 2934 to 3013

<400> 15

Gln Val Lys Ile Arg Gly His Arg Val Glu Leu Gly Glu Val Glu Ser  
1 5 10 15

100806\_01US1.ST25.txt

Val Leu Leu Arg Tyr Asp Thr Val Lys Glu Ala Ala Ala Ile Thr His  
20 25 30

Glu Asp Asp Arg Gly Gln Ala Tyr Leu Cys Ala Tyr Tyr Val Ala Glu  
35 40 45

Gly Glu Ala Thr Pro Ala Gln Leu Arg Ala Tyr Met Glu Asn Glu Leu  
50 55 60

Pro Asn Tyr Met Val Pro Ala Phe Phe Ile Gln Leu Glu Lys Met Pro  
65 70 75 80

<210> 16

<211> 80

<212> PRT

<213> *Bacillus brevis*

<220>

<223> TYCC\_1 Tyrocidine Synthetase III Pos: 859 to 938

<400> 16

Gln Val Lys Ile Arg Gly His Arg Ile Glu Met Gly Glu Ile Glu Thr  
1 5 10 15

Arg Leu Thr Gln His Glu Ala Val Lys Glu Ala Val Val Ile Val Glu  
20 25 30

Lys Asp Glu Ser Gly Gln Asn Val Leu Tyr Ala Tyr Leu Val Ser Glu  
35 40 45

Arg Glu Leu Thr Val Ala Glu Leu Arg Glu Phe Leu Gly Arg Thr Leu  
50 55 60

Pro Ser Tyr Met Ile Pro Ser Phe Phe Ile Arg Leu Ala Glu Ile Pro  
65 70 75 80

<210> 17

<211> 80

<212> PRT

<213> *Bacillus brevis*

<220>

<223> TYCC\_2 Tyrocidine Synthetase III Pos: 1896 to 1975

<400> 17

Gln Val Lys Ile Arg Gly His Arg Ile Glu Leu Gly Glu Ile Glu Ala  
1 5 10 15

Thr Leu Leu Gln His Glu Ala Val Lys Ala Val Val Val Met Ala Arg  
Page 10

100806\_01US1.ST25.txt  
20 25 30

Gln Asp Gly Lys Gly Gln Asn Ser Leu Tyr Ala Tyr Val Val Ala Glu  
35 40 45

Gln Asp Ile Gln Thr Ala Glu Leu Arg Thr Tyr Leu Ser Ala Thr Leu  
50 55 60

Pro Ala Tyr Met Val Pro Ser Ala Phe Val Phe Leu Glu Gln Leu Pro  
65 70 75 80

<210> 18  
<211> 80  
<212> PRT  
<213> Bacillus brevis

<220>  
<223> TYCC\_3 Tyrocidine Synthetase III Pos: 2934 to 3013

<400> 18

Gln Val Lys Val Arg Gly Tyr Arg Ile Glu Ile Gly Glu Ile Glu Ser  
1 5 10 15

Ala Leu Leu Ala Ala Glu Lys Leu Thr Ala Ala Val Val Val Val Tyr  
20 25 30

Glu Asp Gln Leu Gly Gln Ser Ala Leu Ala Ala Tyr Phe Thr Ala Asp  
35 40 45

Glu Gln Leu Asp Val Thr Lys Leu Trp Ser His Leu Ser Lys Arg Leu  
50 55 60

Pro Ser Tyr Met Ile Pro Ala His Phe Val Gln Leu Asp Gln Leu Pro  
65 70 75 80

<210> 19  
<211> 80  
<212> PRT  
<213> Bacillus brevis

<220>  
<223> TYCC\_4 Tyrocidine Synthetase III Pos: 3969 to 4048

<400> 19

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Leu Gly Glu Ile Glu Thr  
1 5 10 15

Val Leu Ser Gln Gln Ala Gln Val Lys Glu Ala Val Val Ala Val Ile  
20 25 30

100806\_01US1.ST25.txt  
Glu Glu Ala Asn Gly Gln Lys Ala Leu Cys Ala Tyr Phe Val Pro Glu  
35 40 45

Gln Ala Val Asp Ala Ala Glu Leu Arg Glu Ala Met Ser Lys Gln Leu  
50 55 60

Pro Gly Tyr Met Val Pro Ala Tyr Tyr Val Gln Met Glu Lys Leu Pro  
65 70 75 80

<210> 20  
<211> 80  
<212> PRT  
<213> Bacillus brevis

<220>  
<223> TYCC\_5 Tyrocidine Synthetase III Pos: 5013 to 5092

<400> 20

Gln Val Lys Ile Arg Gly Val Arg Ile Glu Leu Gly Glu Ile Glu Thr  
1 5 10 15

Gln Leu Arg Lys Leu Asp Gly Ile Thr Glu Ala Val Val Val Ala Arg  
20 25 30

Glu Asp Arg Gly Gln Glu Lys Glu Leu Cys Ala Tyr Val Val Ala Asp  
35 40 45

His Lys Leu Asp Thr Ala Glu Leu Arg Ala Asn Leu Leu Lys Glu Leu  
50 55 60

Pro Gln Ala Met Ile Pro Ala Tyr Phe Val Thr Leu Asp Ala Leu Pro  
65 70 75 80

C  
C  
<210> 21  
<211> 81  
<212> PRT  
<213> Bacillus brevis

<220>  
<223> TYCC\_6 Tyrocidine Synthetase III Pos: 6055 to 6135

<400> 21

Gln Val Lys Val Arg Gly Tyr Arg Ile Glu Ile Gly Glu Ile Glu Ser  
1 5 10 15

Ala Val Leu Ala Tyr Gln Gly Ile Asp Gln Ala Val Val Val Ala Arg  
20 25 30

Asp Asp Asp Ala Thr Ala Gly Ser Tyr Leu Cys Ala Tyr Phe Val Ala  
35 40 45

100806\_01US1.ST25.txt

Ala Thr Ala Val Ser Val Ser Gly Leu Arg Ser His Leu Ala Lys Glu  
50 55 60

Leu Pro Ala Tyr Met Ile Pro Ser Tyr Phe Val Glu Leu Asp Gln Leu  
65 70 75 80

Pro

<210> 22  
<211> 91  
<212> PRT  
<213> Fusarium scirpi

<220>  
<223> ESYN\_1 Enniatin Synthetase Pos: 883 to 973

<400> 22

Gln Val Lys Ile Arg Gly Gln Arg Val Glu Leu Gly Ala Val Glu Thr  
1 5 10 15

His Leu Arg Gln Gln Met Pro Asp Asp Met Thr Ile Val Val Glu Ala  
20 25 30

Val Lys Phe Ser Asp Ser Ser Thr Thr Val Leu Thr Ala Phe Leu  
35 40 45

Ile Gly Ala Gly Glu Lys Asn Ser His Ile Leu Asp Gln Arg Ala Thr  
50 55 60

Arg Glu Ile Asn Ala Lys Met Glu Gln Val Leu Pro Arg His Ser Ile  
65 70 75 80

Pro Ala Phe Tyr Ile Ser Met Asn Asn Leu Pro  
85 90

<210> 23  
<211> 80  
<212> PRT  
<213> Bacillus licheniformis

<220>  
<223> BACA\_2 Bacitracin Synthetase A Pos: 1470 to 1549

<400> 23

Gln Val Lys Ile Arg Gly Tyr Arg Val Glu Met Gly Glu Ile Glu Asn  
1 5 10 15

Thr Leu Val Ser His Gln Glu Ile Thr Lys Ala Ser Val Ile Asp Tyr  
20 25 30

100806\_01US1.ST25.txt

Thr Ser Pro Asp Gly Ile Lys Asn Leu Tyr Ala Phe Val Val Ala Glu  
35 40 45

Asn Ala Ile Ser Gln Leu Asp Val Lys Glu Phe Leu Gln Lys Thr Leu  
50 55 60

Pro Asp Tyr Met Ile Pro Ala Lys Phe Val Gln Ile Glu Glu Ile Pro  
65 70 75 80

<210> 24  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACA\_3 Bacitracin Synthetase A Pos: 2510 to 2589

<400> 24

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Pro Gly Glu Ile Glu Asn  
1 5 10 15

Arg Leu Leu Lys Tyr Glu Lys Ile Glu Glu Ala Ala Val Ile Ala Arg  
20 25 30

Glu Asp Gly Asp His Asp Pro Tyr Leu Cys Ala Tyr Val Thr Val Lys  
35 40 45

Lys Glu Val Glu Pro Glu Lys Ile Arg Ala Phe Leu Lys Ser Leu  
50 55 60

Pro Asp Tyr Met Ile Pro Gln Tyr Phe Val Gln Leu Asp Gly Leu Pro  
65 70 75 80

<210> 25  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACA\_4 Bacitracin Synthetase A Pos: 3551 to 3630

<400> 25

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Leu Gly Glu Val Glu Gln  
1 5 10 15

Gln Leu Leu Thr His Glu Lys Ile Lys Glu Ala Ala Val Ile Ala Gly  
20 25 30

Lys Asp Gln Asn Gly Asn Ser Tyr Leu Cys Ala Tyr Ile Ala Ser Asp  
Page 14

100806\_01us1.ST25.txt  
35                  40                  45

Lys Glu Leu Pro Ala Ala Asp Val Arg Gln Phe Leu Glu Arg Glu Met  
50                  55                  60

Pro Asp Tyr Met Ile Pro Ser Tyr Phe Val Lys Leu Asp Arg Leu Pro  
65                  70                  75                  80

<210> 26  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACA\_5 Bacitracin Synthetase A Pos: 5060 to 5139

<400> 26

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Leu Gly Glu Ile Glu Ser  
1                  5                  10                  15

Arg Leu Glu Met His Glu Asp Ile Asn Glu Thr Ile Val Thr Val Arg  
20                  25                  30

Glu Asp Glu Glu Ser Arg Pro Tyr Ile Cys Ala Tyr Ile Thr Ala Asn  
35                  40                  45

Arg Glu Ile Ser Leu Asp Glu Leu Lys Gly Phe Leu Gly Glu Lys Leu  
50                  55                  60

Pro Asp Tyr Met Ile Pro Ala Tyr Phe Val Lys Met Asp Lys Leu Pro  
65                  70                  75                  80

<210> 27  
<211> 81  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACB\_1 Bacitracin Synthetase B Pos: 909 to 989

<400> 27

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Leu Glu Ile Glu His  
1                  5                  10                  15

Arg Leu Leu Met Asn Asp Asn Ile Asn Glu Ala Ile Val Val Ala Lys  
20                  25                  30

Glu Asp Gln Glu Asn Ser Lys Tyr Leu Cys Ala Tyr Ile Ala Phe Asn  
35                  40                  45

100806\_01US1.ST25.txt

Asn Lys Asn Ala Asp Ile Glu Gln Val Gln Glu Arg Leu Ala Lys Asp  
50 55 60

Leu Pro Glu Tyr Met Ile Pro Ser Cys Phe Ile Lys Leu Asp Gln Ile  
65 70 75 80

Pro

<210> 28  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACB\_2 Bacitracin Synthetase B Pos: 1953 to 2032

<400> 28

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Thr Gly Glu Ile Glu Thr  
1 5 10 15

Lys Leu Leu Glu Asn Gln Asn Ile Ser Glu Ala Val Val Ile Asp Arg  
20 25 30

Glu Asp Lys Lys Gly His Lys Tyr Leu Cys Ala Tyr Ile Val Ala Arg  
35 40 45

Ala Lys Thr Asn Thr Asn Glu Leu Arg Glu Tyr Leu Ser Asp His Leu  
50 55 60

Pro Asp Tyr Met Leu Pro Ser Tyr Phe Ile Gln Ile Asn Lys Met Pro  
65 70 75 80

<210> 29  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACC\_1 Bacitracin Synthetase C Pos: 855 to 934

<400> 29

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Leu Gly Glu Ile Glu Ser  
1 5 10 15

Arg Leu Glu Met His Glu Asp Ile Asn Glu Thr Ile Val Thr Val Arg  
20 25 30

Glu Asp Glu Glu Ser Arg Pro Tyr Ile Cys Ala Tyr Ile Thr Ala Asn  
35 40 45

100806\_01US1.ST25.txt

Arg Glu Ile Ser Leu Asp Glu Leu Lys Gly Phe Leu Gly Glu Lys Leu  
50 55 60

Pro Glu Tyr Met Ile Pro Ala Tyr Phe Val Lys Met Asp Lys Leu Pro  
65 70 75 80

<210> 30  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACC\_2 Bacitracin Synthetase C Pos: 1887 to 1966

<400> 30

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Leu Gly Glu Ile Glu Asn  
1 5 10 15

Gln Leu Leu Lys Leu Asp Lys Ile Asp Glu Ala Ala Val Ile Ala Arg  
20 25 30

Lys Asp Asp Asp His Ser Asp Tyr Leu Cys Ala Tyr Ile Val Ser Lys  
35 40 45

*Cut*  
Glu Asp Trp Thr Ser Thr Glu Ile Ser Glu Trp Leu Glu Lys Glu Leu  
50 55 60

Pro His Tyr Met Ile Pro Ala Tyr Phe Val Arg Leu Asp Lys Leu Pro  
65 70 75 80

<210> 31  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACC\_3 Bacitracin Synthetase C Pos: 3392 to 3471

<400> 31

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Leu Gly Glu Ile Glu Asn  
1 5 10 15

Gln Leu Leu Lys Ile Glu Gly Ile Asp Ala Ala Val Met Ala Arg  
20 25 30

Glu Asp Gln Ala Gly Gly Lys Tyr Leu Cys Ala Tyr Ile Val Ala Asp  
35 40 45

Lys Ala Ala Gly Val Ala Asp Val Arg Lys Cys Leu Leu Lys Glu Leu  
50 55 60

100806\_01US1.ST25.txt

Pro Asp Tyr Met Val Pro Ser Tyr Phe Val Lys Leu Asp Gln Leu Pro  
65 70 75 80

<210> 32  
<211> 80  
<212> PRT  
<213> *Bacillus licheniformis*

<220>  
<223> BACC\_4 Bacitracin Synthetase C Pos: 4435 to 4514

<400> 32

Gln Val Lys Val Arg Gly Tyr Arg Ile Glu Pro Glu Glu Ile Lys Asn  
1 5 10 15

Arg Leu Leu Ala His Asp Asp Ile Lys Glu Ala Phe Ile Ala Ala Arg  
20 25 30

Glu Asp His Lys Gly Ala Lys Gln Leu Cys Ala Tyr Phe Thr Ala Asp  
35 40 45

Ala Glu Leu Pro Phe Glu Asp Ile Arg Thr Tyr Leu Met His Glu Leu  
50 55 60

Pro Glu Tyr Met Ile Pro Ser Ser Phe Val Gln Ile Glu Lys Met Pro  
65 70 75 80

<210> 33  
<211> 76  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS1\_1 Fengycin Synthetase 1 Pos: 860 to 935

<400> 33

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Pro Gly Glu Ile Glu Ala  
1 5 10 15

Ala Leu Arg Ser Ile Glu Gly Val Arg Glu Ala Ala Val Thr Val Arg  
20 25 30

Thr Asp Ser Gly Glu Pro Glu Leu Cys Ala Tyr Val Glu Gly Leu Gln  
35 40 45

Arg Asn Glu Val Arg Ala Gln Leu Gln Arg Leu Leu Pro Gly Tyr Met  
50 55 60

Val Pro Ala Tyr Met Ile Glu Met Glu Gln Trp Pro  
Page 18

## 100806\_01US1.ST25.txt

65

70

75

<210> 34  
<211> 79  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS1\_2 Fengycin Synthetase 1 Pos: 1904 to 1982

<400> 34

Gln Val Lys Ile Asn Gly Tyr Arg Ile Glu Thr Glu Glu Ile Glu Ser  
1 5 10 15

Val Leu Leu Gln Thr Gly Leu Val Arg Glu Ala Ala Val Ala Val Gln  
20 25 30

His Asp Lys Asn Gly Gln Ala Gly Leu Ala Ala Tyr Ile Val Pro Ser  
35 40 45

Asp Val Asn Thr Asn Ala Leu Arg Ala Ala Leu Thr Lys Glu Leu Pro  
50 55 60

Ala Tyr Met Ile Pro Ala Tyr Leu Ile Pro Leu Val Asn Met Pro  
65 70 75

<210> 35  
<211> 80  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS2\_1 Fengycin Synthetase 2 Pos: 860 to 940

<400> 35

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Leu Arg Glu Ile Glu Thr  
1 5 10 15

Val Leu Arg Gln Ala Pro Gly Val Lys Glu Ala Ala Val Leu Ala Arg  
20 25 30

Asp Val Ser Ala Glu Glu Lys Glu Leu Val Ala Tyr Ile Val Pro Glu  
35 40 45

Lys Gly Asn Ser Leu Pro Asp Leu Tyr Gln His Leu Ala Gly Thr Leu  
50 55 60

Pro Ser Tyr Met Ile Pro Ala Ser Ile Ile Asn Ile Ser Gln Met Pro  
65 70 75 80

100806\_01US1.ST25.txt

<210> 36  
<211> 82  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS2\_2 Fengycin Synthetase 2 Pos: 1899 to 1980

<400> 36

Gln Val Lys Val Arg Gly His Arg Ile Glu Leu Gly Glu Ile Gln Ala  
1 5 10 15

Ala Leu Leu Gln Tyr Pro Met Ile Lys Glu Ala Ala Val Ile Thr Arg  
20 25 30

Ala Asp Glu Gln Gly Gln Thr Ala Ile Tyr Ala Tyr Met Val Ile Lys  
35 40 45

Asp Gln Gln Ala Ala Asn Ile Ser Asp Ile Arg Thr Tyr Leu Lys Asn  
50 55 60

Ala Leu Pro Asp Phe Met Leu Pro Ala Arg Met Ile Gln Ile Asp Ser  
65 70 75 80

Ile Pro

<210> 37  
<211> 76  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS3\_1 Fengycin Synthetase 3 Pos: 866 to 941

<400> 37

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Pro Gly Glu Ile Glu Ala  
1 5 10 15

Ala Leu Arg Ser Ile Glu Gly Val Arg Glu Ala Ala Val Thr Val Arg  
20 25 30

Thr Asp Ser Gly Glu Pro Glu Leu Cys Ala Tyr Val Glu Gly Leu Gln  
35 40 45

Arg Asn Glu Val Arg Ala Gln Leu Gln Arg Leu Leu Pro Gly Tyr Met  
50 55 60

Val Pro Ala Tyr Met Ile Glu Met Glu Gln Trp Pro  
65 70 75

100806\_01us1.ST25.txt

<210> 38  
<211> 80  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS3\_2 Fengycin Synthetase 3 Pos: 1899 to 1978

<400> 38

Gln Val Lys Val Arg Gly Tyr Arg Val Glu Leu Gly Glu Ile Glu Thr  
1 5 10 15

Ala Leu Arg Gln Ile Asp Gly Val Lys Glu Ala Ala Val Leu Ala Arg  
20 25 30

Thr Ala Gln Thr Gly Ser Lys Glu Leu Phe Gly Tyr Ile Ser Val Lys  
35 40 45

Ala Gly Thr Asn Ala Glu Gln Val Arg Ser Leu Leu Ala Arg Ser Leu  
50 55 60

Pro Asn Tyr Met Ile Pro Ala Tyr Ile Ile Glu Met Glu Thr Leu Pro  
65 70 75 80

<210> 39  
<211> 80  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS4\_1 Fengycin Synthetase 4 Pos: 861 to 940

<400> 39

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Pro Gln Glu Ile Glu Val  
1 5 10 15

Thr Leu Met Asn His Pro Asp Ile Ser Glu Ala Ala Ile Leu Ile Trp  
20 25 30

Gln Asp Gln Asn Gly Glu His Glu Leu Cys Ala Tyr Tyr Cys Ser Val  
35 40 45

Gln Lys Leu Asn Thr Ile Asp Leu Arg Ser Tyr Met Ala Ser Glu Leu  
50 55 60

Pro Glu Tyr Met Ile Pro Ala Lys Trp Ile Trp Val Asp Ser Ile Pro  
65 70 75 80

<210> 40  
<211> 76

100806\_01US1.ST25.txt

<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS4\_2 Fengycin Synthetase 4 Pos: 1896 to 1971

<400> 40

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Pro Gly Glu Ile Glu Ala  
1 5 10 15

Ala Leu Arg Ser Ile Glu Gly Val Arg Glu Ala Ala Val Thr Val Arg  
20 25 30

Thr Asp Ser Gly Glu Pro Glu Leu Cys Ala Tyr Val Glu Gly Leu Gln  
35 40 45

Arg Asn Glu Val Arg Ala Gln Leu Glu Arg Leu Leu Pro Gly Tyr Met  
50 55 60

Val Pro Ala Tyr Met Ile Glu Met Glu Gln Trp Pro  
65 70 75

<210> 41  
<211> 80  
<212> PRT  
<213> *Bacillus subtilis*

<220>  
<223> PPS4\_3 Fengycin Synthetase 4 Pos: 2928 to 3007

<400> 41

Gln Val Lys Ile Arg Gly Tyr Arg Val Glu Thr Lys Glu Ile Glu Ser  
1 5 10 15

Val Ile Arg Cys Ile Lys Gly Val Lys Asp Ala Ala Val Val Ala His  
20 25 30

Val Thr Ala Ser Gly Gln Thr Glu Leu Ser Ala Tyr Val Val Thr Lys  
35 40 45

Pro Gly Leu Ser Thr Asn Ala Val Arg Ser Glu Leu Gln Asn Lys Leu  
50 55 60

Pro Val Phe Met His Pro Ala Phe Ile Glu Lys Leu Asp Ser Leu Pro  
65 70 75 80

<210> 42  
<211> 82  
<212> PRT  
<213> *Bacillus licheniformis*

100806\_01US1.ST25.txt

<220>  
<223> LICA\_1 Lichenysin Synthetase A Pos: 864 to 943

<400> 42

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Leu Gly Glu Ile Glu Ser  
1 5 10 15

Val Leu Gln Gly Ala Pro Ala Val Gly Lys Ala Val Val Leu Ala Arg  
20 25 30

Pro Glu Thr Gly Gly Ser Leu Glu Val Cys Ala Tyr Val Val Pro Lys  
35 40 45

Gln Ser Gly Glu Ile His Leu Gln Gly Leu Arg Glu His Leu Ser Lys  
50 55 60

His Leu Pro Asp Tyr Met Ile Pro Ser His Phe Val Glu Leu Asp Glu  
65 70 75 80

Ile Pro

<210> 43  
<211> 80  
<212> PRT  
<213> Bacillus licheniformis

<220>  
<223> LICA\_2 Lichenysin Synthetase A Pos: 1905 to 1984

<400> 43

Gln Val Lys Ile Arg Gly Gln Arg Ile Glu Leu Gly Glu Ile Glu His  
1 5 10 15

His Leu Val Thr His Glu Met Val Gln Glu Ala Ala Val Leu Ala Val  
20 25 30

Asp Thr Gly Lys Arg Asp Gln Met Ile Cys Ala Tyr Phe Thr Ala Asp  
35 40 45

Gln Glu Leu Ser Ser Glu Glu Leu Arg Arg Tyr Ala Ala Glu Gly Leu  
50 55 60

Pro Gly Tyr Met Ile Pro Ser Val Phe Met Gln Leu Gln Glu Leu Pro  
65 70 75 80

<210> 44  
<211> 80  
<212> PRT  
<213> Bacillus licheniformis

100806\_01US1.ST25.txt

<220>  
<223> LICA\_3 Lichenysin Synthetase A Pos: 2932 to 3011

<400> 44

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Leu Ser Glu Ile Glu Val  
1 5 10 15

Gln Leu Ala Arg Leu Ser Glu Val Gln Glu Ala Val Val Thr Asp Ile  
20 25 30

Glu Asp Ala Cys Gly Asn Lys Ala Leu Cys Gly Tyr Val Val Ala Asn  
35 40 45

Glu Gln Leu Asp Thr Glu Ser Leu Ala Arg Lys Leu Ala Gln Thr Leu  
50 55 60

Pro Asp Tyr Met Val Pro Ser Phe Trp Val Gln Leu Lys Glu Leu Pro  
65 70 75 80

<210> 45

<211> 78

<212> PRT

<213> Bacillus licheniformis

C  
Cont  
<220>  
<223> LICB\_1 Lichenysin Synthetase B Pos: 859 to 936

<400> 45

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Leu Gly Glu Val Glu Ala  
1 5 10 15

Ala Leu Ala Arg Leu Glu Gly Ile Ser Glu Ala Ala Ala Val Ile Arg  
20 25 30

Glu Asn Asn Ala Gly Glu Asn Glu Ile Cys Ala Tyr Tyr Ala Gly Ala  
35 40 45

Arg Pro Ala Ala Gln Leu Arg Thr Glu Leu Ser Arg Ser Leu Pro Glu  
50 55 60

Tyr Met Ile Pro Ala His Leu Ile Glu Leu Asp Ser Met Pro  
65 70 75

<210> 46

<211> 80

<212> PRT

<213> Bacillus licheniformis

<220>  
<223> LICB\_2 Lichenysin Synthetase B Pos: 1900 to 1979

100806\_01US1.ST25.txt

<400> 46

Gln Val Lys Ile Arg Gly Tyr Arg Ile Glu Leu Lys Glu Ile Glu Glu  
1 5 10 15

Ala Phe Asn Gly Leu Asp Asp Ile Glu Arg Ala Ile Val Leu Ser Phe  
20 25 30

Thr Thr Asp Ser Gly Leu Asp Glu Leu Cys Ala Tyr Ile Gln Ala Lys  
35 40 45

Arg Gln Leu Pro Val Ser Glu Leu Arg Glu Arg Leu Ser Glu Arg Leu  
50 55 60

Pro Ser Tyr Met Ile Pro Ser Tyr Phe Val Thr Val Asp Lys Met Pro  
65 70 75 80

<210> 47

<211> 80

<212> PRT

<213> *Bacillus licheniformis*

<220>

<223> LICB\_3 Lichenysin Synthetase B Pos: 2932 to 3011

<400> 47

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Leu Ser Glu Ile Glu Val  
1 5 10 15

Gln Leu Ala Arg Leu Ser Glu Val Gln Glu Ala Val Val Thr Asp Ile  
20 25 30

Glu Asp Ala Cys Gly Asn Lys Ala Leu Cys Gly Tyr Val Val Ala Asn  
35 40 45

Glu Gln Leu Asp Thr Glu Ser Leu Ala Arg Lys Leu Ala Gln Thr Leu  
50 55 60

Pro Asp Tyr Met Val Pro Ser Phe Trp Val Gln Leu Asp Glu Leu Pro  
65 70 75 80

<210> 48

<211> 82

<212> PRT

<213> *Bacillus licheniformis*

<220>

<223> LICC\_1 Lichenysin Synthetase C Pos: 872 to 953

<400> 48

100806\_01US1.ST25.txt

Gln Val Lys Ile Arg Gly His Arg Ile Glu Leu Gly Glu Ile Glu Glu  
1 5 10 15

Glu Leu Met Arg Cys Gln Gly Val Lys Glu Ala Val Val Ile Ala Lys  
20 25 30

Lys Arg Gly Asn Gly Asp Ala Ala Leu Thr Ala Tyr Val Val Pro Val  
35 40 45

Arg Gly Ala Val Val Ser Asn Glu Glu Val Arg Arg Gln Leu Ala Arg  
50 55 60

Asn Leu Pro Ala Tyr Met Val Pro Asp Ala Tyr Ile Met Leu Glu Glu  
65 70 75 80

Leu Pro

<210> 49  
<211> 82  
<212> PRT  
<213> Streptomyces pristinaespiralis

<220>  
<223> SNBC\_1 Pristinamycin I Synthetase C Pos: 841 to 922

<400> 49

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Leu Gly Glu Ile Glu Asn  
1 5 10 15

Val Leu Ala Thr His Pro Gly Val Ala Gln Ala Ala Ala Val Val Arg  
20 25 30

Glu Asp Arg His Gly Asp Leu Arg Leu Ala Ala Tyr Ala Val Pro Thr  
35 40 45

Pro Gly Thr Glu Pro Asp Val Ala Gly Trp Arg Ala Leu Leu Ala Gly  
50 55 60

Gln Leu Pro Ala His Ser Leu Pro Ala Ser Phe Thr Leu Leu Ala Ala  
65 70 75 80

Leu Pro

<210> 50  
<211> 81  
<212> PRT  
<213> Streptomyces pristinaespiralis

100806\_01US1.ST25.txt

<220>  
<223> SNBD\_1 Pristinamycin I Synthetase D Pos: 859 to 939

<400> 50

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Pro Gly Glu Ile Glu Ala  
1 5 10 15

Ala Leu Thr Asp Leu Pro Ala Val Ala Arg Ala Ala Val Val Val Arg  
20 25 30

Glu Asp Arg Pro Gly Asp Lys Arg Leu Val Ala Tyr Ala Val Pro Ala  
35 40 45

Gly Glu Gly Leu Asp Ala Ala Val Arg Ser Arg Leu Ala Arg Thr  
50 55 60

Leu Pro Asp Phe Met Val Pro Ala Ala Ile Val Ala Leu Asp Ala Leu  
65 70 75 80

Pro

<210> 51  
<211> 75  
<212> PRT  
<213> Streptomyces pristinaespiralis

<220>  
<223> SNBD\_3 Pristinamycin I Synthetase D Pos: 3340 to 3415

<400> 51

Gln Val Lys Ile Arg Gly Phe Arg Val Glu Pro Gly Glu Val Glu Ala  
1 5 10 15

Ala Leu Thr Ala His Pro Arg Ile Thr Gln Ala Ala Val Leu Ala His  
20 25 30

Gly Asp Arg Leu Val Ala Tyr Val Val Thr Thr Ala Asp Arg Asp Leu  
35 40 45

Thr Gly Val Arg Glu His Leu Ala Ala Arg Leu Pro Asp Phe Met Val  
50 55 60

Pro Thr Ala Tyr Val Arg Leu Glu Ala Leu Pro  
65 70 75

<210> 52  
<211> 83  
<212> PRT  
<213> Streptomyces pristinaespiralis

100806\_01us1.ST25.txt

<220>  
<223> SNBD\_4 Pristinamycin I Synthetase D Pos: 4398 to 4480

<400> 52

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Pro Gly Glu Ile Glu Thr  
1 5 10 15

Ala Leu Ala Ala His Pro Asp Val Thr Arg Ala Ala Val Val Ala Arg  
20 25 30

Pro Gly Arg Ala Gly Asp Lys Val Leu Val Ala Tyr Leu Val Thr Ala  
35 40 45

Pro Asp Ala Gly Asp Thr Thr Ala Glu Gln Leu Arg Ala Gly Leu Glu  
50 55 60

Thr Gln Leu Pro Asp Tyr Met Val Pro Ala Ala Phe Val Ala Leu Pro  
65 70 75 80

Ala Leu Pro

C /  
Cult  
<210> 53  
<211> 82  
<212> PRT  
<213> Streptomyces pristinaespiralis

<220>  
<223> SNBC\_2 Pristinamycin I Synthetase C Pos: 1900 to 1981

<400> 53

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Leu Gly Glu Ile Glu Ser  
1 5 10 15

Val Leu Gly Ala His Pro Gly Ile Ala Gln Ser Ala Val Leu Val Arg  
20 25 30

Glu Asp Arg Pro Gly Asp Lys Arg Leu Val Ala Tyr Val Val Pro Ala  
35 40 45

Pro Gly Ala Thr Ala Asp Ala Thr Val Leu Arg Arg His Val Ala Ala  
50 55 60

Ala Leu Pro Asp Tyr Met Val Pro Ala Ala Phe Val Pro Leu Asp Ala  
65 70 75 80

Leu Pro

100806\_01US1.ST25.txt

<210> 54  
<211> 80  
<212> PRT  
<213> Streptomyces chrysomallus

<220>  
<223> ACMB\_1 Actinomycin Synthetase II Pos: 875 to 954

<400> 54

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Leu Gly Glu Val Glu Ala  
1 5 10 15

Ala Leu Leu Ala His Pro Asp Val Glu Gln Ala Thr Val Ile Val Arg  
20 25 30

Glu Asp Arg Pro Gly Asp Thr Arg Leu Val Ala Tyr Val Val Gly Arg  
35 40 45

Glu Ala Leu Arg Pro Glu Gln Val Arg Glu Phe Thr Arg Glu Arg Leu  
50 55 60

Pro Glu His Met Val Pro Ala Ala Val Val Gln Leu Glu Arg Leu Pro  
65 70 75 80

<210> 55  
<211> 80  
<212> PRT  
<213> Streptomyces chrysomallus

<220>  
<223> ACMB\_2 Actinomycin Synthetase II Pos: 1924 to 2003

<400> 55

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Pro Gly Glu Ile Glu Asn  
1 5 10 15

Val Leu Thr Gly His Pro Ala Val Ala Gln Ala Ala Ile Leu Val Arg  
20 25 30

Glu Asp Gln Pro Gly Arg Pro Arg Leu Val Ala Tyr Val Val Ala Asp  
35 40 45

Gly Gly Thr Ala Pro Asp Gly Leu Arg Glu Ala Leu Arg Arg Arg Leu  
50 55 60

Pro Glu Tyr Met Val Pro Ser Ala Phe Val Val Leu Asp Arg Leu Pro  
65 70 75 80

<210> 56  
<211> 80

100806\_01US1.ST25.txt

<212> PRT

<213> Streptomyces chrysomallus

<220>

<223> ACMC\_1 Actinomycin Synthetase III Pos: 865 to 944

<400> 56

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Pro Gly Glu Ile Glu Lys  
1 5 10 15

Val Leu Thr Asp His Pro Asp Ile Ala Gln Ala Ala Val Val Thr Arg  
20 25 30

Pro His Arg Pro Gly Asp Thr Arg Leu Val Ala Tyr Val Val Gly Arg  
35 40 45

Glu Ala Leu Arg Pro Glu Gln Val Arg Glu Phe Thr Arg Glu Arg Leu  
50 55 60

Pro Glu His Met Val Pro Ala Ala Val Val Gln Leu Glu Arg Leu Pro  
65 70 . 75 80

<210> 57

<211> 73

<212> PRT

<213> Streptomyces chrysomallus

<220>

<223> ACMC\_2 Actinomycin Synthetase III Pos: 1922 to 1994

<400> 57

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Pro Gly Glu Ile Glu Lys  
1 5 10 15

Val Leu Thr Asp His Pro Asp Ile Ala Gln Ala Ala Val Val Val Arg  
20 25 30

Glu Asp Gln Pro Gly Asp Ala Arg Leu Val Ala Tyr Val Val Thr Gly  
35 40 45

Gly Ser Ala Asp Ala Arg Asp Glu Gln Val Glu Gln Asp Gln Leu Asp  
50 55 60

Glu Trp Gln Asp Leu Tyr Asp Ser Val  
65 70

<210> 58

<211> 40

<212> PRT

<213> Streptomyces chrysomallus

100806\_01US1.ST25.txt

<220>  
<223> ACMC\_2 Actinomycin Synthetase III Pos: 2379 to 2418

<400> 58

Thr Asn Pro Ala Ala Gly Arg Gly Thr Ser Ala Leu Leu Thr Thr Leu  
1 5 10 15

Arg Glu His Ala Arg Thr His Leu Pro Asp Tyr Met Gln Pro Ser Ala  
20 25 30

Leu Val Pro Leu Asp Arg Leu Pro  
35 40

<210> 59

<211> 72

<212> PRT

<213> Streptomyces chrysomallus

<220>  
<223> ACMC\_3 Actinomycin Synthetase III Pos: 3389 to 3460

<400> 59

Gln Val Lys Val Arg Gly Phe Arg Ile Glu Pro Gly Glu Ile Glu Asn  
1 5 10 15

Val Leu Thr Asp His Pro Ala Val Ala Gln Ala Ala Val His Leu Asn  
20 25 30

Arg Asp Gln Pro Gly Asn Pro Arg Leu Val Ala Tyr Val Val Ala Asp  
35 40 45

Thr Ser Ala Pro Ser Ser Asp Val Asp Gln Gln His Gln Ile Gly Glu  
50 55 60

Trp Gln Asp Leu Tyr Asp Ser Leu  
65 70

<210> 60

<211> 40

<212> PRT

<213> Streptomyces chrysomallus

<220>  
<223> ACMC\_3 Actinomycin Synthetase II Pos: 3837 to 3876

<400> 60

Thr Asn Pro Val Gly Ser Arg Gly Thr Ala Ala Leu Leu Thr Ala Leu  
1 5 10 15

Arg Glu His Ala Ala Ala Gln Leu Pro Asp Tyr Met Arg Pro Ala Ala  
20 25 30

100806\_01US1.ST25.txt

Ile Val Pro Leu Asp Arg Leu Pro  
35 40

<210> 61  
<211> 74  
<212> PRT  
<213> Streptomyces pristinaespiralis

<220>  
<223> SNBD\_2 Pristinamycin I Synthetase D Pos: 1901 to 1974

<400> 61

Gln Val Lys Ile Arg Gly Phe Arg Ile Glu Pro Gly Glu Ile Glu Thr  
1 5 10 15

Val Leu Thr Ala His Pro Ala Val Ala Ala Gly Ala Val Ile Ala Arg  
20 25 30

Glu Asp Thr Pro Gly Asp Lys Gln Leu Val Ala Tyr Leu Thr Arg Asp  
35 40 45

Thr Thr His His Ala Ala Pro Asp Gln Asp Leu Gly Thr Gly Gln Val  
50 55 60

Asp Arg Trp Gln Gln Thr Tyr Asp Ser Leu  
65 70

<210> 62  
<211> 41  
<212> PRT  
<213> Streptomyces pristinaespiralis

<220>  
<223> SNBD\_2 Pristinamycin I Synthetase D Pos: 2331 to 2370

<400> 62

Ala Asn Asp Pro Ala Arg Ala Glu Gln Asp Ala Ala Leu Val Gly Glu  
1 5 10 15

Leu Arg Asp Leu Val Ala Gln Arg Leu Pro Ala His Met Ala Pro Ala  
20 25 30

Ala Tyr Val Leu Leu Asp Arg Leu Pro  
35 40

<210> 63  
<211> 73  
<212> PRT  
<213> Tolypocladium niveum

100806\_01us1.ST25.txt

<220>  
<223> CYSA\_2 Cyclosporine Synthetase Pos: 1976 to 2048

<400> 63

Gln Val Lys Val Arg Gly His Arg Ile Glu Leu Ala Glu Val Glu His  
1 5 10 15

Ala Leu Leu Ser Ser Ala Gly Val His Asp Ala Val Val Val Ser Asn  
20 25 30

Ser Gln Glu Asp Asn Gln Gly Val Glu Met Val Ala Phe Ile Thr Ala  
35 40 45

Gln Asp Asn Glu Thr Leu Gln Glu Ala Gln Ser Ser Asn Gln Val Gln  
50 55 60

Glu Trp Glu Ser His Phe Glu Thr Thr  
65 70

<210> 64  
<211> 41  
<212> PRT  
<213> *Tolypocladium niveum*

<220>  
<223> CYSA\_2 Cyclosporine Synthetase Pos: 2454 to 2494

<400> 64

Thr Asn Arg Pro Leu Gln Arg Val Glu Ser Arg Arg Ile Glu Ala Gln  
1 5 10 15

Val Arg Glu Gln Leu Gln Val Leu Leu Pro Ala Tyr Met Ile Pro Ala  
20 25 30

Arg Ile Val Val Leu Gln Asn Met Pro  
35 40

<210> 65  
<211> 71  
<212> PRT  
<213> *Tolypocladium niveum*

<220>  
<223> CYSA\_3 Cyclosporine Synthetase Pos: 3471 to 3540

<400> 65

Gln Val Lys Ile Arg Gly His Arg Ile Glu Pro Ala Glu Val Glu Tyr  
1 5 10 15

Ala Leu Leu Ser His Asp Leu Val Thr Asp Ala Ala Val Val Thr His  
20 25 30

100806\_01US1.ST25.txt

Ser Gln Glu Asn Gln Asp Leu Glu Met Val Gly Phe Val Ala Ala Arg  
35 40 45

Val Ala Asp Val Arg Glu Asp Glu Ser Ser Asn Gln Val Gln Glu Trp  
50 55 60

Gln Thr His Phe Asp Ser Ile  
65 70

<210> 66  
<211> 41  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_3 Cyclosporine Synthetase Pos: 3941 to 3981

<400> 66

Thr Asn His Pro Leu His Arg Ala Gln Ser Arg Arg Val Glu Arg Gln  
1 5 10 15

Ile Arg Glu Arg Leu Gln Thr Leu Leu Pro Ala Tyr Met Ile Pro Ala  
20 25 30

Gln Ile Met Val Leu Asp Lys Leu Pro  
35 40

<210> 67  
<211> 72  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_4 Cyclosporine Synthetase Pos: 4960 to 5031

<400> 67

Gln Ile Lys Ile Arg Gly His Arg Ile Glu Pro Ala Glu Val Glu Gln  
1 5 10 15

Ala Phe Leu Asn Asp Gly Phe Val Glu Asp Val Ala Ile Val Ile Arg  
20 25 30

Thr Pro Glu Asn Gln Glu Pro Glu Met Val Ala Phe Val Thr Ala Lys  
35 40 45

Gly Asp Asn Ser Ala Arg Glu Glu Glu Ala Thr Thr Gln Ile Glu Gly  
50 55 60

Trp Glu Ala His Phe Glu Gly Gly

65

70

<210> 68  
<211> 41  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_4 Cyclosporine Synthetase Pos: 5433 to 5473

<400> 68

Thr Asn Gln Pro Leu Leu Pro Ala Gln Ser Arg Arg Ala Glu Leu Leu  
1 5 10 15

Ile Arg Glu Gly Leu Gln Thr Leu Leu Pro Pro Tyr Met Ile Pro Ser  
20 25 30

Gln Ile Thr Leu Ile Asp Arg Met Pro  
35 40

<210> 69  
<211> 76  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_5 Cyclosporine Synthetase Pos: 6450 to 6525

<400> 69

Gln Val Lys Ile Arg Gly His Arg Ile Glu Pro Gly Glu Val Glu Ser  
1 5 10 15

Ala Leu Leu Ser His Asn Ser Val Gln Asp Ala Ala Val Val Ile Cys  
20 25 30

Ala Pro Ala Asp Gln Asp Ser Gly Ala Glu Met Val Ala Phe Val Ala  
35 40 45

Ala Arg Asn Thr Glu Asp Gln Asp Thr Gln Glu Glu Glu Ala Val Asp  
50 55 60

Gln Val Gln Gly Trp Glu Thr His Phe Glu Thr Ala  
65 70 75

<210> 70  
<211> 40  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_5 Cyclosporine Synthetase Pos: 6931 to 6970

100806\_01us1.ST25.txt

<400> 70

Asn Arg Pro Leu Asn Ser Ile Gln Ser Arg Arg Leu Gly Thr Gln Ile  
1 5 10 15

Arg Glu Lys Leu Gln Thr Leu Leu Pro Pro Tyr Met Ile Pro Ser Arg  
20 25 30

Ile Met Val Leu Asp Gln Met Pro  
35 40

<210> 71

<211> 72

<212> PRT

<213> Tolypocladium niveum

<220>

<223> CYSA\_7 Cyclosporine Synthetase Pos: 9010 to 9081

<400> 71

Gln Val Lys Ile Arg Gly His Arg Ile Glu Pro Ala Glu Val Glu His  
1 5 10 15

Ala Leu Leu Gly His Asp Leu Val His Asp Ala Ala Val Val Leu Arg  
20 25 30

Lys Pro Ala Asn Gln Glu Pro Glu Met Ile Ala Phe Ile Thr Ser Gln  
35 40 45

Glu Asp Glu Thr Ile Glu Gln His Glu Ser Asn Lys Gln Val Gln Gly  
50 55 60

Trp Gly Glu His Phe Asp Val Ser  
65 70

<210> 72

<211> 41

<212> PRT

<213> Tolypocladium niveum

<220>

<223> CYSA\_7 Cyclosporine Synthetase Pos: 9485 to 9525

<400> 72

Thr Asn Arg Pro Leu Gln Arg Ala Gln Ser Arg Arg Ile Glu Ser Gln  
1 5 10 15

Val Phe Glu Ala Leu Gln Thr Ala Leu Pro Ala Tyr Met Ile Pro Ser  
20 25 30

Arg Ile Ile Val Leu Pro Gln Met Pro

35

40

<210> 73  
<211> 73  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_8 Cyclosporine Synthetase Pos: 10501 to 10573

<400> 73

Gln Val Lys Ile Arg Gly His Arg Val Glu Pro Ala Glu Val Glu Gln  
1 5 10 15

Ala Met Leu Gly Asn Lys Ala Ile His Asp Ala Ala Val Val Val Gln  
20 25 30

Ala Val Asp Gly Gln Glu Thr Glu Met Ile Gly Phe Val Ser Met Ala  
35 40 45

Ser Asp Arg Phe Ser Glu Gly Glu Glu Ile Thr Asn Gln Val Gln  
50 55 60

Glu Trp Glu Asp His Phe Glu Ser Thr  
65 70

<210> 74  
<211> 41  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_8 Cyclosporine Synthetase Pos: 10982 to 11022

<400> 74

Thr Ser Arg Pro Leu Gln Arg Ile Gln Asn Arg Arg Phe Glu Ser Gln  
1 5 10 15

Ile Arg Glu Gln Leu Gln Thr Leu Leu Pro Pro Tyr Met Val Pro Ser  
20 25 30

Arg Ile Val Val Leu Glu Arg Met Pro  
35 40

<210> 75  
<211> 71  
<212> PRT  
<213> Tolypocladium niveum

<220>  
<223> CYSA\_10 Cyclosporine Synthetase Pos: 13068 to 13138

100806\_01US1.ST25.txt

<400> 75

Gln Ile Lys Ile Arg Gly His Arg Ile Glu Pro Ala Glu Val Glu Gln  
1 5 10 15

Ala Leu Leu Ser Asp Ser Ser Ile Asn Asp Ala Val Val Val Ser Ala  
20 25 30

Gln Asn Lys Glu Gly Leu Glu Met Val Gly Tyr Ile Thr Thr Gln Ala  
35 40 45

Ala Gln Ser Val Asp Lys Glu Glu Ala Ser Asn Lys Val Gln Glu Trp  
50 55 60

Glu Ala His Phe Asp Ser Thr  
65 70

<210> 76

<211> 41

<212> PRT

<213> Tolypocladium niveum

<220>

<223> CYSA\_10 Cyclosporine Synthetase Pos: 13549 to 13589

<400> 76

Thr Asn Arg Pro Leu His Leu Leu Gln Ser Arg Arg Leu Glu Ala Lys  
1 5 10 15

Val Arg Glu Arg Leu Gln Ser Leu Leu Pro Pro Tyr Met Ile Pro Ser  
20 25 30

Arg Ile Thr Leu Leu Asp Gln Met Pro  
35 40

<210> 77

<211> 74

<212> PRT

<213> Fusarium scirpi

<220>

<223> ESYN\_2 Enniatin Synthetase Pos: 1956 to 2026

<400> 77

Gln Phe Lys Ile Arg Gly Asn Arg Ile Glu Ala Gly Glu Val Glu Ser  
1 5 10 15

Ala Met Leu Ser Leu Lys Asn Val Leu Asn Ala Ala Ile Val Arg Gly  
20 25 30

Gly Gly Glu Asp Glu Gly Pro Leu Glu Met Val Gly Phe Ile Val Ala  
Page 38

35

40

100806\_01us1.ST25.txt

45

Asp Asp Lys Asn Asp Thr Thr Glu Glu Glu Glu Thr Gly Asn Gln Val  
50 55 60

Glu Gly Trp Gln Asp His Phe Glu Ser Gly  
65 70

C  
Catalytic  
<210> 78  
<211> 41  
<212> PRT  
<213> Fusarium scirpi

<220>  
<223> ESYN\_2 Enniatin Synthetase Pos: 2433 to 2473

<400> 78

Ala Asn Arg Pro Leu Gln Lys Leu Gln Arg Arg Arg Ala Ala Leu Gln  
1 5 10 15

Val Arg Glu Lys Leu Gln Thr Leu Val Pro Ser Tyr Met Val Pro Pro  
20 25 30

Asn Ile Val Val Leu Asp Thr Met Pro  
35 40